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Note on the Comparative Eccentricities of Visual and Spectroscopic Binary Stars. By T. J. J. See, A.M., Ph.D. (Berol.).

For some time the writer has been occupied with a critical examination of the comparative eccentricities of visual and spectroscopic binary stars, in the hope of obtaining an observational criterion that will throw light on the evolution of these systems. It is now clear that the investigation will afford the criterion sought; and as he recently had occasion to mention the general result in letters to some friends abroad, it seems likely that a preliminary notice of this work may be of interest to the Society.

If we exclude from consideration all binaries telescopically resolvable in modern instruments, there remain about 30 orbits of purely spectroscopic binaries, which have been worked out from spectrograms taken chiefly at the Lick, Yerkes, and Potsdam Observatories. The eccentricity is well determined, and the average value for these 30 systems is about 0·22. In the case of very rapid binaries, with periods often much less than a day, the orbits are practically circular. Dr. A. W. Roberts and Professor G. W. Myers have investigated the light changes of certain variables, and shown that they are composed of two stars in the process of separation, and therefore revolving in orbits which are without sensible eccentricity.

The average eccentricity of visual binary stars remains about 0·50, as indicated in the work *Researches on the Evolution of the Stellar Systems,* vol. i., published in 1896. The subject has, however, been so much extended and improved during the past eleven years that it has seemed advisable to re-examine each orbit anew. There are about 80 orbits in which the eccentricity may be fairly well determined. I hope to have the final result of this examination ready for presentation to the Society in a short time. The work is already so far advanced that we may confidently state that *the average eccentricity among visual binaries is considerably more than twice that among the spectroscopic binaries.* The latter are stellar systems, with components so close together, owing to the small size of their orbits, or so far removed from us in space, that we cannot resolve them even in the greatest of modern telescopes. In some cases they are closer sub-systems of known visual binary stars. Among such systems we may mention ξ Ursae Majoris, κ Pegasi, α Geminorum, etc., which are spectroscopically subdivided in exact analogy to the many double stars which have been resolved into triple stars by increase of modern telescopic power; but where the spectroscopic binaries stand alone, we can infer the average size of their orbits only from the generalised form of Kepler's law.

For a large number of systems we are justified in assuming that the average mass will be the same among the spectroscopic as among the visual binary stars. And as the periods of the spectroscopic binaries are much shorter than those of the visual binaries, it

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follows also that their mean distances are correspondingly smaller. This conclusion might indeed fail here and there in particular cases, but, as applied generally to these two classes of bodies, is entirely valid.

Accordingly, we see that in the universe generally small eccentricity is connected with the small mean distance, and *vice versa*. This confirms, from an observational standpoint, the theory of the development of these systems long ago inferred from other considerations (*cf.* the writer's *Inaugural Dissertation*, Berlin, 1892). Heretofore scarcely anyone has dared to hope that a direct confirmation of this theory would ever be possible; but, unless this reasoning is entirely at fault, such a positive confirmation is near at hand, and is due to the notable advance in our knowledge of the stars arising from the discovery and investigation of spectroscopic binaries, chiefly during the past ten years.

U.S. Naval Observatory,
Mare Island, California:
1907 *November* 30.

Micrometrical Measures of Double Stars (Fifth Series). By the Rev. T. E. Espin, M.A.

In the early part of 1907 very few known double stars were measured, pending the arrival of Burnham's General Catalogue. The latter part of the year has been devoted to the completion of measures of new pairs, and to the measurement of such stars of Sir John Herschel's as have not been remeasured since his observation of them. The places are those of the General Catalogue (1880); but in several cases, as explained in the notes, corrections to Herschel's places have been made.

h.	R.A. 1880.		Decl.		P.	D.	Mags.	Nights.	Date.
	h	m	°	′	°	″			
1009	0	9·6	+47	56	26·7	16·77	9·0, 9·1	2	1907·760 AB
					140·9	36·15	11·7	2	·760 AC
1029		25·9	44	16	279·9	11·85	8·8, 10·4	3	·905
1985		28·4	48	11	143·3	17·97	10·0, 10·2	2	·851
1049		38·0	50	6	303·1	15·32	9·2, 11·0	3	·784
1050		38·1	44	23	185·1	13·97	9·7, 10·7	2	·896
1058		51·0	49	34	283·7	11·70	10·2, 10·3	3	·862
1060		52·0	44	16	293·1	9·48	9·5, 10·7	4	·924
2013		59·2	44	8	247·0	23·22	8·5, 11·5	2	·891
2031	1	9·6	43	49	260·6	20·15	8·5, 12·7	2	·903 BC
					342·2	45·52	A= 8·0	2	·903 AB

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